

PHOTOSYNTHETIC REACTION CENTER COMPLEXES FROM HELIOBACTERIA

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Photosynthetic reaction centers are pigment-protein complexes that are responsible for the transduction of light energy into chemical energy. Considerable evidence indicates that photosynthetic organisms were present very early in the evolution of life on Earth. The goal of this project is to understand the early evolutionary development of photosynthesis by examining the properties of reaction centers isolated from certain contemporary organisms that appear to contain the simplest photosynthetic reaction centers. The major focus of this project is the family of newly discovered strictly anaerobic photosynthetic organisms known as Heliobacteria. These organisms are the only known photosynthetic organisms that are grouped with the gram-positive phylum of bacteria. The properties of these reaction centers suggest that they may be the descendants of an ancestor that also gave rise to Photosystem I found in oxygen-evolving photosynthetic organisms.

Photoactive reaction center-core antenna complexes have been isolated from the photosynthetic bacteria *Heliobacillus mobilis* and *Helio bacterium gestii* by extraction of membranes with Deriphat 160C followed by differential centrifugation and sucrose density gradient centrifugation (Trost and Blankenship, Biochemistry 28, 9898-9904, 1989). The purified complexes contain one or more 48,000 Mr peptides that bind both the photoactive chlorophyll P800 and approximately 25 molecules of antenna bacteriochlorophyll g. Time-resolved fluorescence spectroscopy indicates that the antenna pigment are active in energy transfer to P800, exhibiting a major decay time of 25 ps in both membranes and reaction centers. The absorption and fluorescence properties of membranes and reaction centers are almost identical, suggesting that a single pigment-protein complex serves as both antenna and reaction center. Experiments in progress include sequence determination of the 48,000 Mr reaction center protein, and evolutionary comparisons with other reaction center proteins. These experiments are being done using chemical sequencing methods to obtain a partial sequence, followed by oligonucleotide synthesis and DNA hybridization to obtain the gene(s) for the protein(s).